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Optimization of 3D Printing Conditions for Pectin-based Medium Chain Triglycerides (MCT) Oil Oleogels

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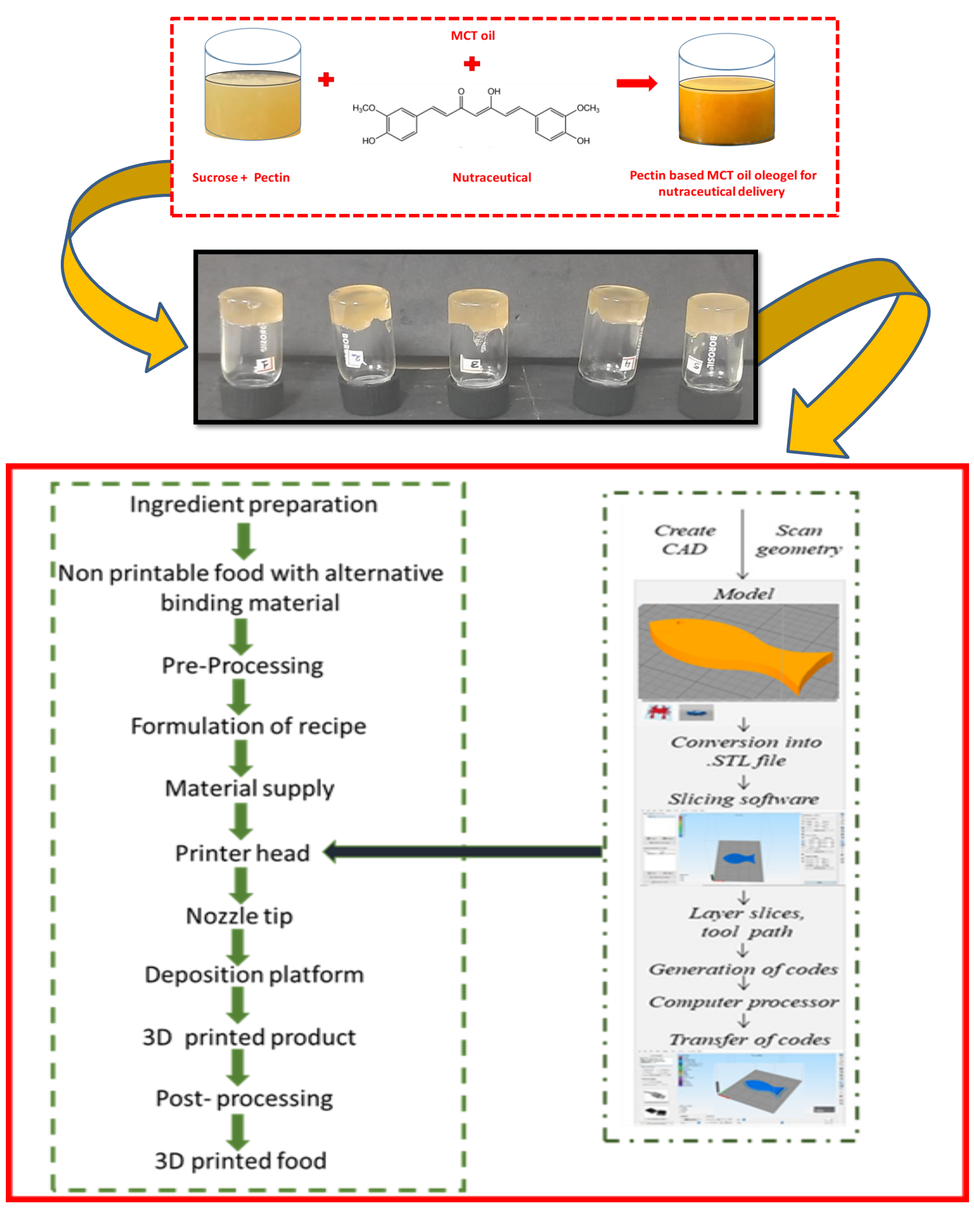
INTRODUCTION & AIM

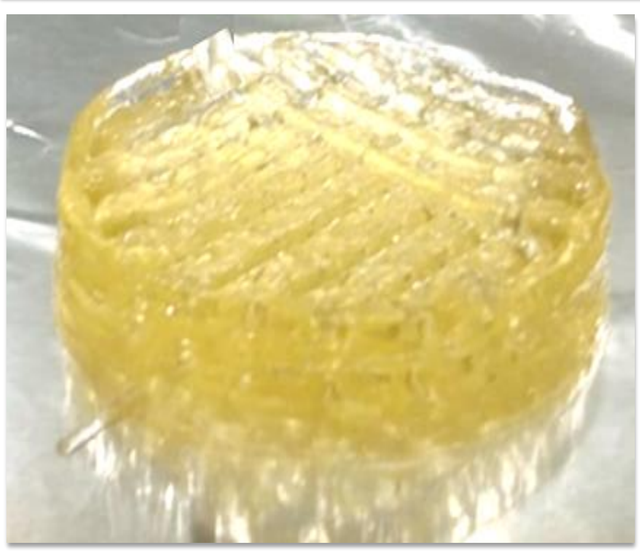
- 3D food printing has the potential to revolutionize food production by enabling the creation of personalized dietary products.
- A key challenge is understanding and controlling the rheological properties of ingredients to improve the printability of complex food matrices.
- MCT oil-based oleogels, structured with pectin, present a novel platform for nutraceutical delivery through 3D printing.
- The aim is to optimize 3D printing conditions for MCT oil-based oleogels using pectin, with the goal of developing a customizable matrix for nutraceutical delivery.

METHOD

- Oleogel formulations were prepared by varying the ratios of MCT oil (2.5-40%), sucrose (10-30%), and pectin (2-10%).
- Sucrose syrup prepared with 55^{o} brix and then homogenized at 15,000 rpm with MCT oil stabilizer and emulsifier.
- Oleogels analysed for oil binding capacity, rheology, texture and extrusion process for 3D printability.



RESULTS & DISCUSSION



Fresh oleogel

Dried oleogel

- Optimized oleogel exhibited 80% oil binding capacity, indicating high oil retention.
- Highest firmness (1022.20 g) and consistency (663.42 g·sec) among formulations; moderate bonding strength requiring less energy for deformation.
- Shear-thinning behavior confirmed via rheological analysis, essential for extrusion-based 3D printing.
- Validated printability using a 1.2 mm nozzle at 40 rpm motor speed, pressure <1 bar showcasing the potential for stable, intricate structures.
- Developed gel does not require post-processing.

CONCLUSION

- MCT oil-based oleogels with sugar and pectin offer a novel approach to nutraceutical delivery via 3D printing.
- These oleogels show potential for personalized medicine and nutraceutical applications.

REFERENCES

Nachal, N., Moses, J. A., Karthik, P., & Anandharamakrishnan, C. (2019). Applications of 3D printing in food processing. Food Engineering Reviews, 11(3), 123-141.

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